

CIRCUIT DESCRIPTION

The KEC 1000 is a U.S. designed and manufactured Active Electronic Crossover for automotive use, executed to Professional Audio Standards.
(For component designations, refer to schematic Page 4.)

POWER CIRCUIT

The 13.8V (nominal) DC input is coupled through an inline fuse for circuit protection while diode D1 provides protection against damage from power connection reversal.

DC filtration is achieved by inductor L1 and capacitor C1, forming a passive second order low pass filter. A series pass Darlington transistor Q1 is used as power switch, turning on when 12V DC is applied from input connector pin 3, originated by program source equipment. This CONTROL voltage is coupled through a first order low pass filter (R2 and C2) to the base of Q1, here establishing a voltage ramp at the emitter. Upon removal of the control voltage, R1 provides a discharge path for C2.

Capacitor C3 adds DC filtration and energy storage while C4 and C5 contribute localized high frequency power decoupling.

A buffered reference (V_R) is derived from the filtered DC power by a voltage divider (R3 and R4) with C6 providing HF decoupling. OpAmp U7 is connected as a unity gain voltage follower for V_R .

SYSTEM SELECT

Considerations when system selection is made:

- The position of the System Select switch;
- The combination of output connectors used.
(The MID-RANGE OUTPUT is always used.)

FIG I: OUTPUT SELECTION

SYSTEM	OUTPUTS		
	LOW	MID	HIGH
SUB	○	○	—
2-A	○	○	—
2-B	—	○	○
3	○	○	○

CIRCLES INDICATE OUTPUT USED IN RESPECTIVE SYSTEM MODES.

In the SUB (woofer) mode the two MID filters are bypassed leaving the MID signal unaffected. The LO signal chain feeds the woofers.

FIG II: ACTIVE FILTERS

FILTER	SYSTEM			
	SUB	2A	2B	3
LOW	○	○	—	○
MID LOW	—	○	—	○
MID HIGH	—	—	○	○
HIGH	—	—	○	○

CIRCLES INDICATE FILTERS USED IN RESPECTIVE SYSTEM MODES.

In 2-WAY A operation, the MID LO filter establishes a crossover match with the LO RANGE filter in the 50 Hz to 1.6kHz tuning range.

2-WAY B selection substitutes the MID HIGH filter, used with the HI RANGE filter and its matching 1.6kHz to 8kHz tuning range.

In the 3-WAY mode both MID filters are used to establish the midrange bandpass of the two crossover points.

SIGNAL PATH AND FILTERS

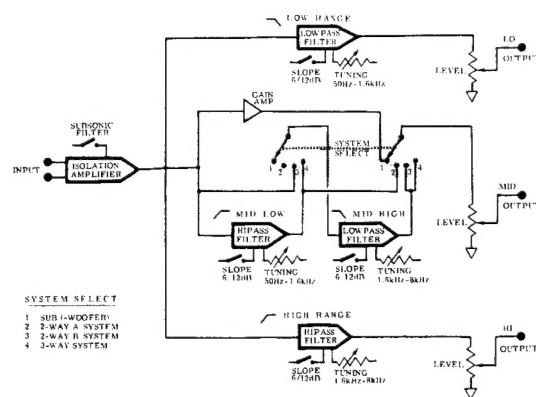
The audio signal is input via connector J1; pin 1 Left, pin 4 Right, and pin 2 Common.

The differential OpAmp U1 provides rejection of unwanted noise which may appear on the input signal lines. The amplifier provides a 4dB voltage gain and combines with a subsonic filter consisting of capacitor C100/C200. When switched into circuit this yields a first order, -6dB/octave highpass filter with -3dB response at 20Hz.

The output of U1 is then split five ways: (see Block Diagram Fig. III).

- To LOW RANGE filter
- To GAIN STAGE
- To SYSTEM SELECT switch
- To MID LOW filter
- To HI RANGE filter

FIG III: BLOCK DIAGRAM



With the SLOPE push switches OUT, the filters are first order (-6dB/octave) tunable frequency filters and are followed by IC OpAmps having a 6dB voltage gain. With switches IN, they become Voltage Controlled Voltage Source (VCVS) second order (-12dB/octave) tunable frequency filters, each with a 6dB voltage gain.

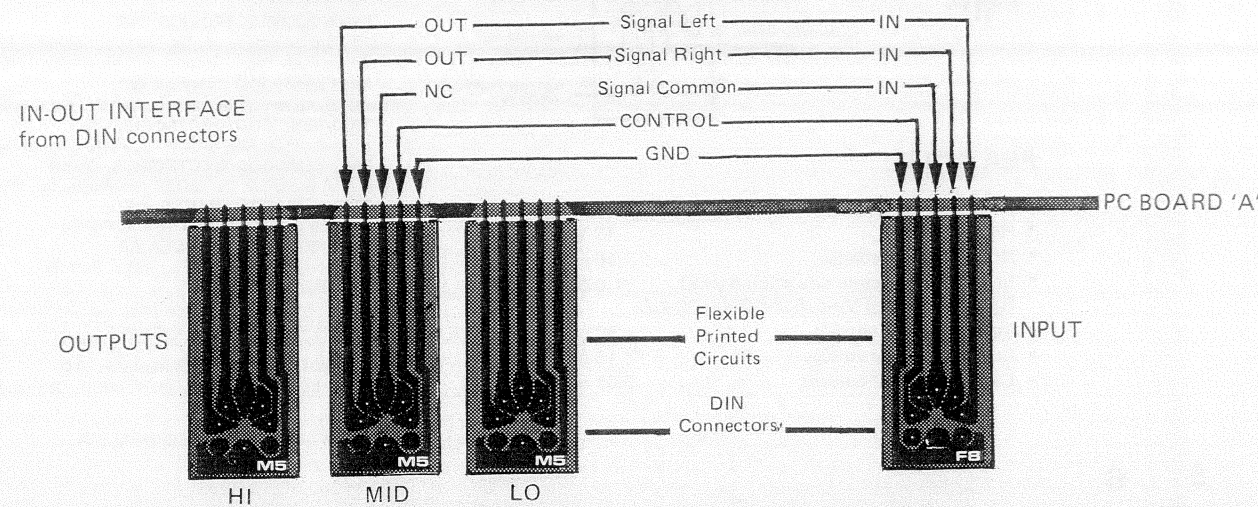
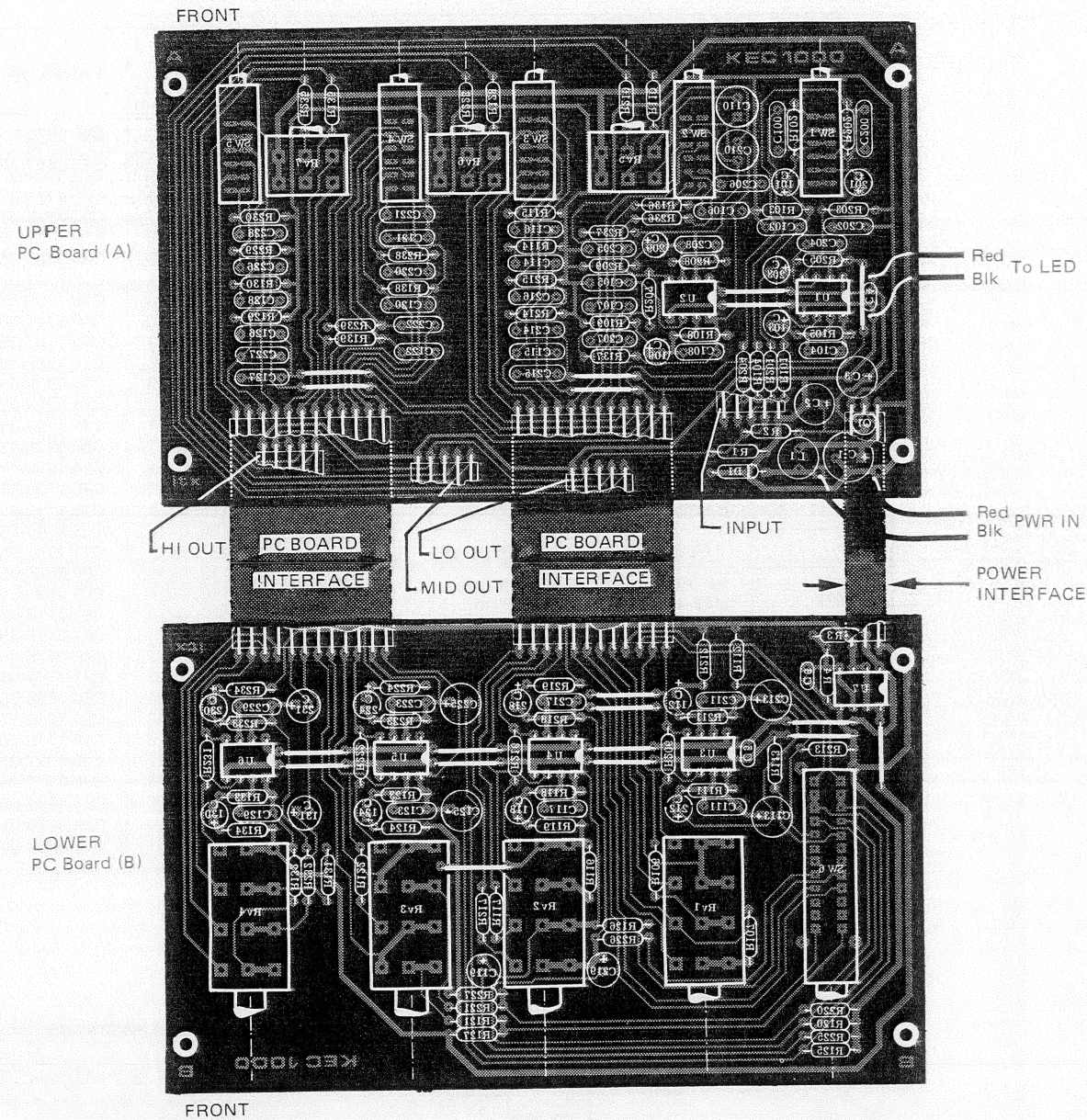
Low pass filters (LOW RANGE and MID HI) have a damping ratio of 1.0 to insure low overshoot in transient response. The high pass filters (MID LO and HI RANGE) have a damping ratio of 0.707 (Butterworth) for flatness of response.

All outputs are capacitively coupled into output level control potentiometers, preceding respective output connectors.

KEC-1000

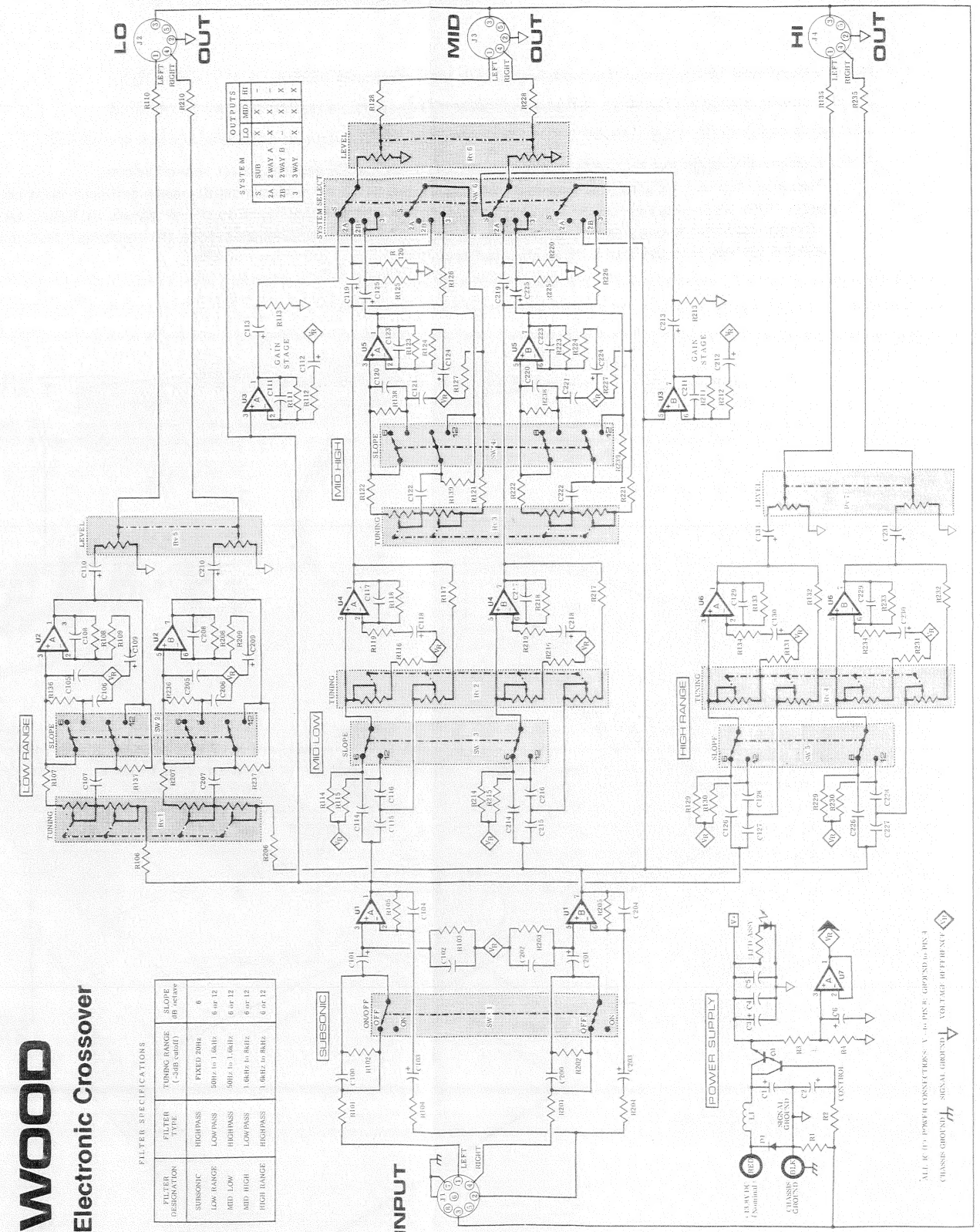
PC BOARDS

Foil side view. Boards are shown spread apart, joined by interface conductor assemblies.



SCHEMATIC

KEC-1000



KENWOOD

KEC1000 Electronic Crossover

COMPONENT VALUES

RESISTORS	VALUES
R1, R2, R3, R4	10k ohm
R5, R6, R7, R8	1M ohm
R9, R10, R11, R12	15k ohm
R13, R14, R15, R16	150 ohm
R17, R18, R19, R20	15k ohm
R21, R22, R23, R24	150 ohm
R25, R26, R27, R28	15k ohm
R29, R30, R31, R32	150 ohm
R33, R34, R35, R36	15k ohm
R37, R38, R39, R40	150 ohm
R41, R42, R43, R44	15k ohm
R45, R46, R47, R48	150 ohm
R49, R50, R51, R52	15k ohm
R53, R54, R55, R56	150 ohm
R57, R58, R59, R60	15k ohm
R61, R62, R63, R64	150 ohm
R65, R66, R67, R68	15k ohm
R69, R70, R71, R72	150 ohm
R73, R74, R75, R76	15k ohm
R77, R78, R79, R80	150 ohm
R81, R82, R83, R84	15k ohm
R85, R86, R87, R88	150 ohm
R89, R90, R91, R92	15k ohm
R93, R94, R95, R96	150 ohm
R97, R98, R99, R100	15k ohm
R101, R102, R103, R104	150 ohm
R105, R106, R107, R108	15k ohm
R109, R110, R111, R112	150 ohm
R113, R114, R115, R116	15k ohm
R117, R118, R119, R120	150 ohm
R121, R122, R123, R124	15k ohm
R125, R126, R127, R128	150 ohm
R129, R130, R131, R132	15k ohm
R133, R134, R135, R136	150 ohm
R137, R138, R139, R140	15k ohm
R141, R142, R143, R144	150 ohm
R145, R146, R147, R148	15k ohm
R149, R150, R151, R152	150 ohm
R153, R154, R155, R156	15k ohm
R157, R158, R159, R160	150 ohm
R161, R162, R163, R164	15k ohm
R165, R166, R167, R168	150 ohm
R169, R170, R171, R172	15k ohm
R173, R174, R175, R176	150 ohm
R177, R178, R179, R180	15k ohm
R181, R182, R183, R184	150 ohm
R185, R186, R187, R188	15k ohm
R189, R190, R191, R192	150 ohm
R193, R194, R195, R196	15k ohm
R197, R198, R199, R200	150 ohm
R201, R202, R203, R204	15k ohm
R205, R206, R207, R208	150 ohm
R209, R210, R211, R212	15k ohm
R213, R214, R215, R216	150 ohm
R217, R218, R219, R220	15k ohm
R221, R222, R223, R224	150 ohm
R225, R226, R227, R228	15k ohm
R229, R230, R231, R232	150 ohm
R233, R234, R235, R236	15k ohm
R237, R238, R239, R240	150 ohm
R241, R242, R243, R244	15k ohm
R245, R246, R247, R248	150 ohm
R249, R250, R251, R252	15k ohm
R253, R254, R255, R256	150 ohm
R257, R258, R259, R260	15k ohm
R261, R262, R263, R264	150 ohm
R265, R266, R267, R268	15k ohm
R269, R270, R271, R272	150 ohm
R273, R274, R275, R276	15k ohm
R277, R278, R279, R280	150 ohm
R281, R282, R283, R284	15k ohm
R285, R286, R287, R288	150 ohm
R289, R290, R291, R292	15k ohm
R293, R294, R295, R296	150 ohm
R297, R298, R299, R300	15k ohm
R301, R302, R303, R304	150 ohm
R305, R306, R307, R308	15k ohm
R309, R310, R311, R312	150 ohm
R313, R314, R315, R316	15k ohm
R317, R318, R319, R320	150 ohm
R321, R322, R323, R324	15k ohm
R325, R326, R327, R328	150 ohm
R329, R330, R331, R332	15k ohm
R333, R334, R335, R336	150 ohm
R337, R338, R339, R340	15k ohm
R341, R342, R343, R344	150 ohm
R345, R346, R347, R348	15k ohm
R349, R350, R351, R352	150 ohm
R353, R354, R355, R356	15k ohm
R357, R358, R359, R360	150 ohm
R361, R362, R363, R364	15k ohm
R365, R366, R367, R368	150 ohm
R369, R370, R371, R372	15k ohm
R373, R374, R375, R376	150 ohm
R377, R378, R379, R380	15k ohm
R381, R382, R383, R384	150 ohm
R385, R386, R387, R388	15k ohm
R389, R390, R391, R392	150 ohm
R393, R394, R395, R396	15k ohm
R397, R398, R399, R400	150 ohm
R401, R402, R403, R404	15k ohm
R405, R406, R407, R408	150 ohm
R409, R410, R411, R412	15k ohm
R413, R414, R415, R416	150 ohm
R417, R418, R419, R420	15k ohm
R421, R422, R423, R424	150 ohm
R425, R426, R427, R428	15k ohm
R429, R430, R431, R432	150 ohm
R433, R434, R435, R436	15k ohm
R437, R438, R439, R440	150 ohm
R441, R442, R443, R444	15k ohm
R445, R446, R447, R448	150 ohm
R449, R450, R451, R452	15k ohm
R453, R454, R455, R456	150 ohm
R457, R458, R459, R460	15k ohm
R461, R462, R463, R464	150 ohm
R465, R466, R467, R468	15k ohm
R469, R470, R471, R472	150 ohm
R473, R474, R475, R476	15k ohm
R477, R478, R479, R480	150 ohm
R481, R482, R483, R484	15k ohm
R485, R486, R487, R488	150 ohm
R489, R490, R491, R492	15k ohm
R493, R494, R495, R496	150 ohm
R497, R498, R499, R500	15k ohm
R501, R502, R503, R504	150 ohm
R505, R506, R507, R508	15k ohm
R509, R510, R511, R512	150 ohm
R513, R514, R515, R516	15k ohm
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R521, R522, R523, R524	15k ohm
R525, R526, R527, R528	150 ohm
R529, R530, R531, R532	15k ohm
R533, R534, R535, R536	150 ohm
R537, R538, R539, R540	15k ohm
R541, R542, R543, R544	150 ohm
R545, R546, R547, R548	15k ohm
R549, R550, R551, R552	150 ohm
R553, R554, R555, R556	15k ohm
R557, R558, R559, R560	150 ohm
R561, R562, R563, R564	15k ohm
R565, R566, R567, R568	150 ohm
R569, R570, R571, R572	15k ohm
R573, R574, R575, R576	150 ohm
R577, R578, R579, R580	15k ohm
R581, R582, R583, R584	150 ohm
R585, R586, R587, R588	15k ohm
R589, R590, R591, R592	150 ohm
R593, R594, R595, R596	15k ohm
R597, R598, R599, R600	150 ohm
R601, R602, R603, R604	15k ohm
R605, R606, R607, R608	150 ohm
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R621, R622, R623, R624	150 ohm
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R629, R630, R631, R632	150 ohm
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R637, R638, R639, R640	150 ohm
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R649, R650, R651, R652	15k ohm
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R661, R662, R663, R664	150 ohm
R665, R666, R667, R668	15k ohm
R669, R670, R671, R672	150 ohm
R673, R674, R675, R676	15k ohm
R677, R678, R679, R680	150 ohm
R681, R682, R683, R684	15k ohm
R685, R686, R687, R688	150 ohm
R689, R690, R691, R692	15k ohm
R693, R694, R695, R696	150 ohm
R697, R698, R699, R700	15k ohm
R701, R702, R703, R704	150 ohm
R705, R706, R707, R708	15k ohm
R709, R710, R711, R712	150 ohm
R713, R714, R715, R716	15k ohm
R717, R718, R719, R720	150 ohm
R721, R722, R723, R724	15k ohm
R725, R726, R727, R728	150 ohm
R729, R730, R731, R732	15k ohm
R733, R734, R735, R736	150 ohm
R737, R738, R739, R740	15k ohm
R741, R742, R743, R744	150 ohm
R745, R746, R747, R748	15k ohm
R749, R750, R751, R752	150 ohm
R753, R754, R755, R756	15k ohm
R757, R758, R759, R760	150 ohm
R761, R762, R763, R764	15k ohm
R765, R766, R767, R768	150 ohm
R769, R770, R771, R772	15k ohm
R773, R774, R775, R776	150 ohm
R777, R778, R779, R780	15k ohm
R781, R782, R783, R784	150 ohm
R785, R786, R787, R788	15k ohm
R789, R790, R791, R792	150 ohm
R793, R794, R795, R796	15k ohm
R797, R798, R799, R800	150 ohm
R801, R802, R803, R804	15k ohm
R805, R806, R807, R808	150 ohm
R809, R810, R811, R812	15k ohm
R813, R814, R815, R816	150 ohm
R817, R818, R819, R820	15k ohm
R821, R822, R823, R824	150 ohm
R825, R826, R827, R828	15k ohm
R829, R830, R831, R832	150 ohm
R833, R834, R835, R836	15k ohm
R837, R838, R839, R840	150 ohm
R841, R842, R843, R844	15k ohm
R845, R846, R847, R848	150 ohm
R849, R850, R851, R852	15k ohm
R853, R854, R855, R856	150 ohm
R857, R858, R859, R860	15k ohm
R861, R862, R863, R864	150 ohm
R865, R866, R867, R868	15k ohm
R869, R870, R871, R872	150 ohm
R873, R874, R875, R876	15k ohm
R877, R878, R879, R880	150 ohm
R881, R882, R883, R884	15k ohm
R885, R886, R887, R888	150 ohm
R889, R890, R891, R892	15k ohm
R893, R894, R895, R896	150 ohm
R897, R898, R899, R900	15k ohm
R901, R902, R903, R904	150 ohm
R905, R906, R907, R908	15k ohm
R909, R910, R911, R912	150 ohm
R913, R914, R915, R916	15k ohm
R917, R918, R919, R920	150 ohm
R921, R922, R923, R924	15k ohm
R925, R926, R927, R928	150 ohm
R929, R930, R931, R932	15k ohm
R933, R934, R935, R936	150 ohm
R937, R938, R939, R940	15k ohm
R941, R942, R943, R944	150 ohm
R945, R946, R947, R948	15k ohm
R949, R950, R951, R952	150 ohm
R953, R954, R955, R956	15k ohm
R957, R958, R959, R960	150 ohm
R961, R962, R963, R964	15k ohm
R965, R966, R967, R968	150 ohm
R969, R970, R971, R972	15k ohm
R973, R974, R975, R976	150 ohm
R977, R978, R979, R980	15k ohm
R981, R982, R983, R984	150 ohm
R985, R986, R987, R988	15k ohm
R989, R990, R991, R992	150 ohm
R993, R994, R995, R996	15k ohm
R997, R998, R999, R1000	150 ohm

CAPACITORS	VALUES
C1, C2, C3	100nF
C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100	100nF

KEC-1000

DISASSEMBLY FOR REPAIR

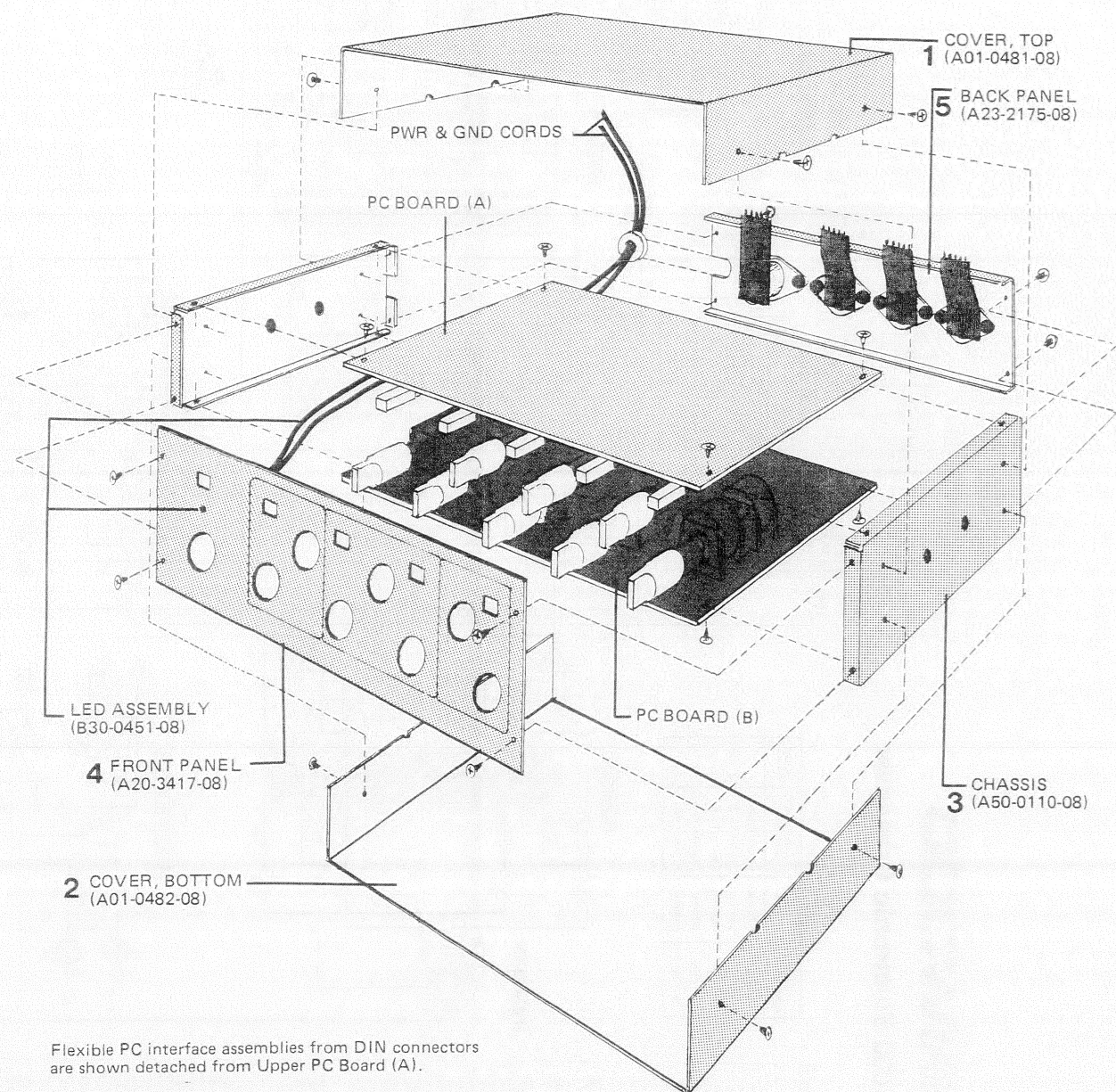
The exploded view below shows the main mechanical parts of the KEC1000.

In most service situations, however, only partial disassembly will be required.

FOR PC BOARD FOIL SIDE ACCESS, remove screws on sides of covers and slip off.

FOR PC BOARD COMPONENT SIDE ACCESS, pull off lower row of knobs.

Thereafter remove LOWER PC BOARD (B) holding screws only and fold front edge of board away from assembly. The board will remain functionally attached to Board (A) via board interface assemblies along rear edge of both PC boards permitting powered testing and service, without further disassembly.



KEC-1000

PARTS LIST

Ref. No. page 1, photos, front & back panels

Ref. No. page 4, schematic

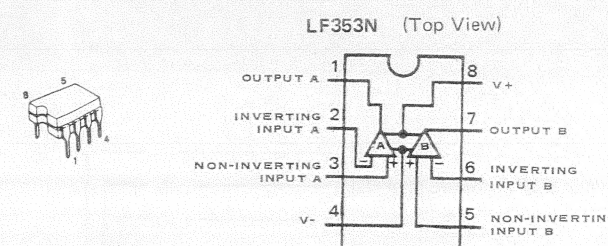
Ref. No. page 5, disassembly drawing

Parts without PARTS NO. are not supplied.

REF. NO.	PARTS NO.	DESCRIPTION
5	1	A01-0481-08 COVER, TOP
5	2	A01-0482-08 COVER, BOTTOM
5	3	A50-0110-08 CHASSIS
5	4	A20-3417-08 FRONT PANEL
5	5	A23-2175-08 BACK PANEL
-	-	J21-3218-08 MOUNTING BRACKET
1	1	K29-0924-04 KNOB, ROTARY
1	2	K27-0928-08 KNOB, PUSH
1	3	E30-0628-05 POWER CORD
1	4	E30-0623-05 GND CORD
-	-	B-50-4631-08 INSTRUCTION MANUAL
-	-	B51-1331-08 SERVICE MANUAL
-	-	H21-0217-08 UNIT CARTON
ELECTRONIC PARTS Ref. page 4		
U1-U7	LF-353-N	DUAL AMP (IC)
Q1	MPS-A13	TRANSISTOR
D1	1N4003	DIODE
LED	B30-0451-08	LED ASSY
L1	L33-0292-08	CHOKE COIL
Rv1-Rv4	R11-4025-08	VAR. RESISTOR 50K Ω x 4
Rv5-Rv7	R06-0002-08	VAR. RESISTOR 500 Ω x 2
SW6	S29-4015-08	SWITCH, ROTARY, 4W4P
SW1-SW5	S40-4049-08	SWITCH, PUSH, 2W4P
J1	E06-0803-08	DIN CONNECTOR, 8P
J2-J4	E06-0518-08	DIN CONNECTOR, 5P

REF. NO.	PARTS NO.	DESCRIPTION
C1	C90-0820-05	CAP. 470uf 16V el
C2, C3	C24-1210-77	CAP. 100uf 16V el
C4, C5, C6,	C90-0824-05	CAP. 0.1uf monolithic
C100, C200	C91-0114-05	CAP. 0.33uf mylar
C101, C201	C90-0825-05	CAP. 22uf 16V el
C102, C202	C71-1747-05	CAP. 47pf mica
C103, C203	C90-0825-05	CAP. 22uf 16V el
C104, C204	C71-1747-05	CAP. 47pf mica
C105, C205	C45-1733-36	CAP. 0.033uf mylar
C106, C206	C45-1722-36	CAP. 0.022uf mylar
C107, C207	C45-1727-35	CAP. 0.027uf mylar
C108, C208	C71-1747-05	CAP. 47pf mica
C109, C209	C90-0825-05	CAP. 22uf 16V el
C110, C210	C24-1210-77	CAP. 100uf 16V el
C111, C211	C71-1747-05	CAP. 47pf mica
C112, C212	C90-0825-05	CAP. 22uf 16V el
C113, C213	C24-1210-77	CAP. 100uf 16V el
C114, C214	C45-1768-36	CAP. 0.068uf mylar
C115, C215	C45-1710-45	CAP. 0.1uf mylar
C116, C216	C45-1747-36	CAP. 0.047 mylar
C117, C217	C71-1747-05	CAP. 47pf mica
C118, C218	C90-0825-05	CAP. 22uf 16V el
C119, C219	C90-0822-05	CAP. 47uf 16V el
C120, C220	C91-0115-05	CAP. 0.0015uf mylar
C121, C221	C91-0115-05	CAP. 0.0015uf mylar
C122, C222	C48-1775-15	CAP. 750pf mica
C123, C223	C71-1747-05	CAP. 47pf mica
C124, C224	C90-0825-05	CAP. 22uf 16V el
C125, C225	C24-1210-77	CAP. 100uf 16V el
C126, C226	C46-1718-26	CAP. 0.0018uf mylar
C127, C227	C45-1727-25	CAP. 0.0027uf mylar
C128, C228	C45-1712-26	CAP. 0.0012uf mylar
C129, C229	C71-1747-05	CAP. 47pf mica
C130, C230	C24-0825-05	CAP. 22uf 16V el
C131, C231	C90-0822-05	CAP. 47uf 16V el

Operational Amplifiers



FEATURES

- Wide gain bandwidth 4 MHz
- High slew rate 13 V/us
- High input impedance $10^{12} \Omega$
- Low total harmonic distortion $A_V=10$, $R_L=10k$, $V_O=20$ Vp-p, BW=20 Hz-20 kHz $< 0.02\%$
- Low input bias current 50 pA
- Low input noise voltage 16 nV/ $\sqrt{\text{Hz}}$
- Low input noise current 0.01 pA/ $\sqrt{\text{Hz}}$

A product of
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